Space Weather Technical Forecast

Issued on Monday, 15 November 2021 at 12:20 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Slight chance of G1/Minor Storm on Day 3 (17 Nov). Slight chance of Active fluence on Day 4 (18 Nov).

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar Activity was Very Low, with no notable flares in the last 24 hours. There are two small and simple sunspot regions on the Earth-facing disc. AR2894 in the southwest remains a simple mature and stable sunspot, classified Hsx/alpha. AR2896 rotated over the southeast limb just over 24 hours ago and is also mature and simple, classified Hsx/alpha. There also appears to be a new region approaching the northeast limb. No Earth-directed CMEs were observed.

Solar Wind / Geomagnetic Activity: The solar wind speed as measured at L1 by DSCOVR, remains slow-ambient varying between 290-320 km/s. Density was largely above average, with a peak of 19 ppcc around 15/0415 UTC. The Interplanetary Magnetic Field strength, Bt, was weak at 6 nT or below, with the north-south component, Bz, varying weakly between +/-4 nT. The phi angle was predominantly negative (towards the Sun). Geomagnetic activity remained Quiet (Kp 0-1).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured by GOES-16, remained at Background levels. The high energy electron flux (greater than 2 MeV) reached High levels between 14/1250-1805 UTC, peaking at 1600 pfu at 14/1620 UTC. The associated 24-hour integrated fluence remained below the Active threshold (1e8 integrated pfu), on a fairly steady trend, with 5.04e7 integrated pfu recorded at 15/0000 UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: Solar activity is expected to be mainly Very Low, with a slight chance of C-class flares.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. Slow-ambient solar winds are likely to continue days 1 and 2 (15th and 16th) before then becoming slightly elevated or elevated on day 3 (17 Nov) due to the arrival of the high speed stream from negative coronal hole 19. Geomagnetic activity is expected to be mostly Quiet, perhaps Unsettled at times, before becoming Unsettled to Active on day 3 with a slight chance of G1/Minor Storm intervals.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to be at background levels. The high energy electron flux (greater than 2 MeV) is expected to continue at moderate, perhaps briefly high levels, but likely slowly declining, before potentially rising again late on day 3 into day 4 (17-18 Nov). The corresponding 24-hour electron fluence is expected to remain below the Active level (1e8 integrated pfu) until day 3, perhaps rising on day 4.

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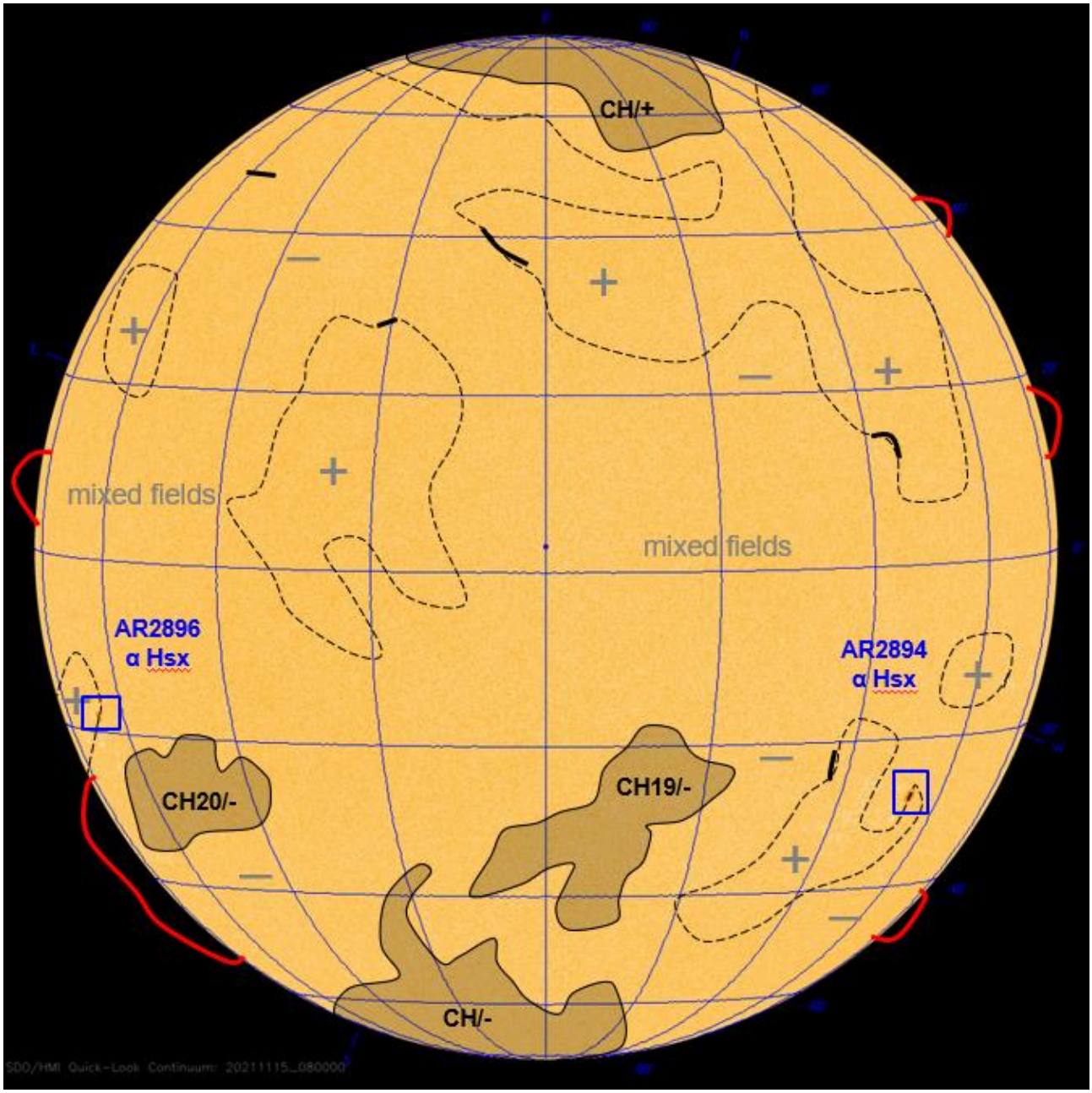
Figure 1. Solar Analysis Valid 15/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are no Earth-directed CMEs. Solar winds are currently slow-ambient, with no notable enhancement expected on days 1 and 2 (15th and 16th). The next feature of interest is the southern hemisphere negative polarity coronal hole 19, which is likely to give a high speed stream (HSS) arrival with wind speeds becoming elevated. This is most probable during day 3 (17th). This feature was present on the previous rotation, but appears to be both smaller and to have retrogressed eastwards, likely indicating a later arrival than 27-day persistence would suggest. This signal is further complicated by a northern hemisphere coronal hole on the previous rotation which is not present on this occasion. However, STEREO-A appears to have seen a possible HSS in line with an arrival time at Earth on day 3.

Geomagnetic activity is expected to be mostly Quiet, with a slight chance of isolated Unsettled intervals, but increasing on day 3 to become Unsettled to Active with a slight chance of G1/Minor Storm intervals.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	20	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
*	*	*	*	*	*	*

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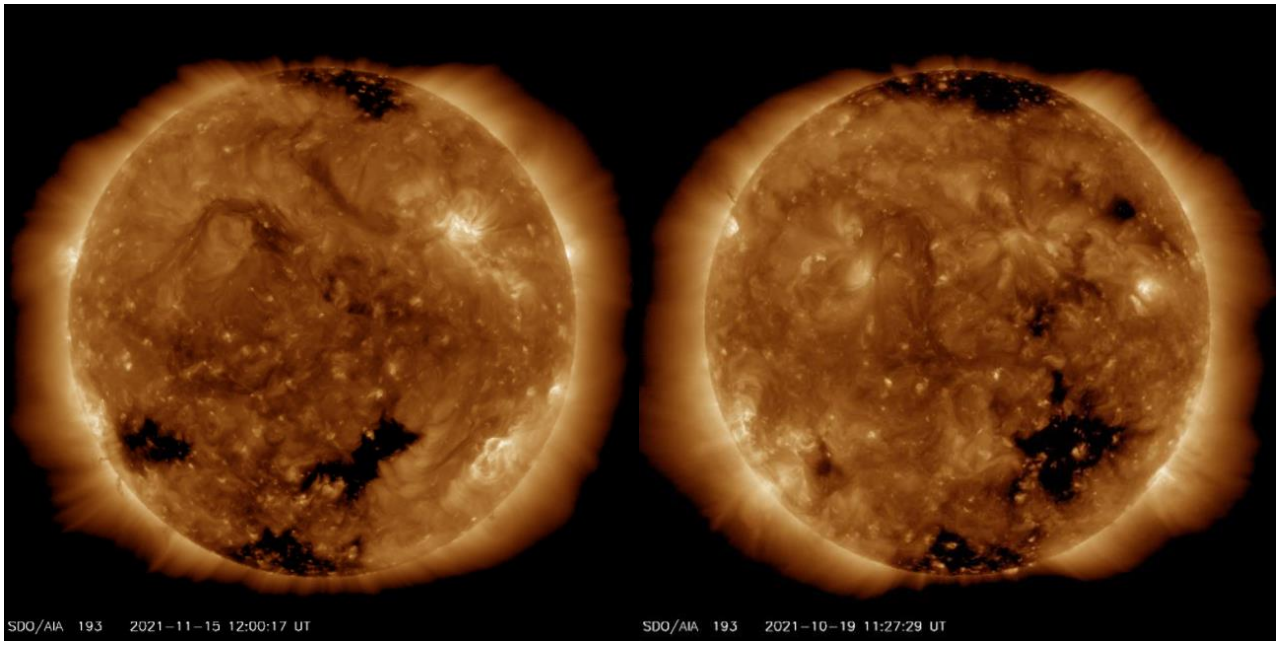
Figure 2: AIA-193 imagery showing CH19 just west of centre disc in the southern hemisphere on this rotation (left) and the previous rotation (right), where it appears to have been further west.



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Radio Blackouts - X-Ray Flares:

Solar Activity is currently Very Low, with only two small and simple sunspot regions on the visible disc. AR2894 (Hsx/alpha) in the southwest remains a simple mature and stable sunspot. AR2896 (Hsx/alpha) has rotated over the southeast limb and also appears to be mature and simple. Another region close to appearing over the northeast limb gave a B-class flare at 14/1845 UTC, and this will be watched with interest as it could be a source of further C-class flares over the coming days. Solar activity is anticipated to remain Very Low with a slight chance of further C-flares.

X Ray Flares / Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	1	1	1	1
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as measured by GOES-16, remained at Background levels during the previous 24 hours, and is currently forecast to remain at this level through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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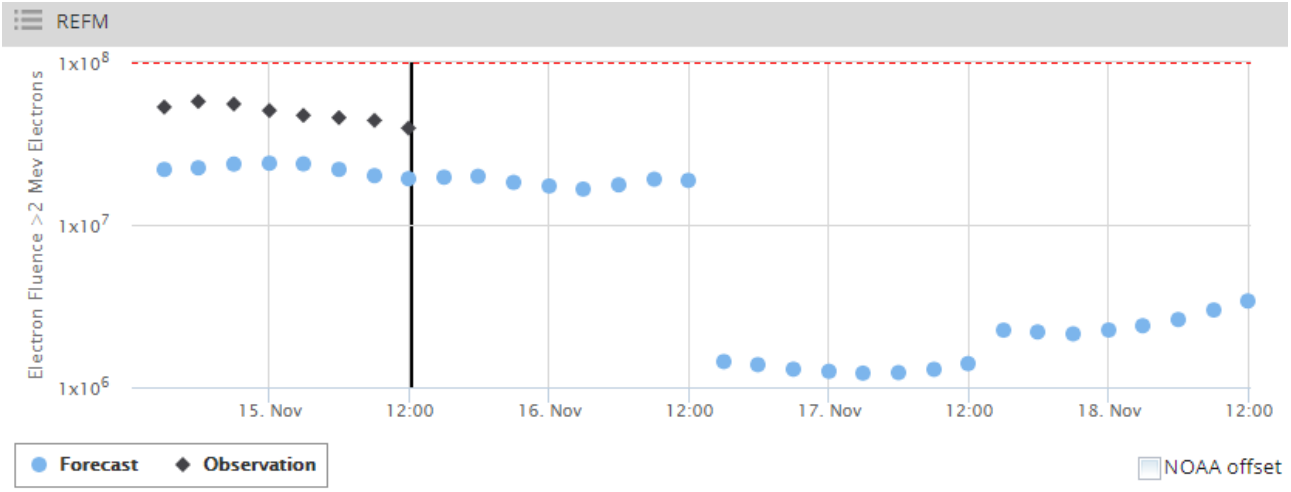
High Energy Electrons Event (≥ 2MeV):
The high energy electron flux (greater than 2 MeV) as measured by GOES-16 at GEO is currently at moderate levels with diurnal maxima reaching high levels (above 1000 pfu). This is likely to slowly decline over the next 2 days (15th and 16th), with peak values only erratically dropping off. On days 3 and 4 (17th and 18th) the arrival of the HSS from CH19/- is likely to initially further suppress flux levels, before bringing some charging to the radiation belts. Therefore flux levels may start to rise by the end of day 3 and into day 4. However, no electron response to this feature was seen on the previous rotation.

The associated 24-hour electron fluence is likely to remain below the Active (1e8 integrated pfu) threshold on days 1 and 2, with a gradual declining trend, perhaps initially becoming a sharper downward trend on day 3. Met Office REFM output is currently considered to be giving good guidance with this. Any increase in the fluence levels due to CH19/- is more likely to occur on day 4, although this is low confidence given the lack of response on the previous rotation.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	5	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: REFM model showing a declining trend the next 3 days. Any electron response is likely to be on day 4 (18 Nov), after the end of the REFM forecast period.



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